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ABSTRACT

An attempt was made to document the beginning of children's ability to make cognitive-emotional discriminations between skill-dependent outcomes and chance-dependent outcomes of performance on tasks. Children between the ages of 2 and 5 years were administered structurally similar achievement games and effect games. It was thought that as soon as success and failure became more to children than just interesting effects with no relevance for self-evaluation, children would discriminate in their emotional reactions between similar physical signals representing either a skill-independent effect, or success or failure in an achievement task. Data were gathered by assessing children's emotional reactions in the two tasks and older children's understanding of the tasks. Subjects of Study I were 40 preschool children. Findings suggested that preschool children differentiated behaviorally--but apparently not conceptually--between events dependent on skill and events dependent on chance. Children manifested as much of a true smile (Darwin, 1872) in failure situations as in success situations; but zygomaticus reactions, or partial smiles, in success trials were somewhat more intense than in failure trials. In Study II children between 2 and 3 years of age were observed while they played the same two games. Findings indicated that children's looking behaviors discriminated between child and experimenter trials. A four-page reference list is included. (RH)

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# The development of emotions in preschool children during achievement-oriented striving*

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The achievement motivation system is thought to develop from precursor behavioral systems (see Heckhausen, 1982, 1984; Trudewind, 1982). Even within the first months of life infants demonstrate excitement and joy in repeating movements and observing their contingent effects (Papousek, 1967; Piaget, 1936; Watson, 1966). However, not before the age of 18 months do children obviously stop in their play activity in order to regard and examine their work outcome, e.g., in building a tower out of wooden blocks (Hetzer, 1931). The work of Heckhausen and associates in the early sixties demonstrated, in addition, that a further step is achieved around the age of 3 1/2 years when children become presumably able to use "standards of excellence" in order to evaluate their performance and thus experience positive and negative emotions depending on the outcome (see Heckhausen, 1984).

The competition with a standard of excellence was inferred in these studies from facial and postural signs of joy and contentment and shame. Because infants manifest such emotional signs as reactions to contingently produced effects as well earlier in their life, such qualitatively assessed emotional reactions signalling joy or contentment cannot be taken at face value as true indicators of achievement dependent emotions or as a result of an evaluative process of task outcomes using a standard of excellence.

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As long as the existence of a standard of excellence is inferred from qualitatively assessed expressive behaviors which are then explained in the theory of achievement motivation through such standards, the argumentation is circular. Only when we can specify differential indices for pure effect joy triggered by contingently and self-produced effects and success joy or pride in an achievement situation will we be able to pigeonhole the developmental sequence of emotional reactions to contingently produced effects and to success and failure in achievement striving.

In addition, it may be helpful to consider that such "self-evaluating" (Heckhausen, 1932) emotions demand that children understand the task situation and task feedback. According to Heckhausen (1972, 1934) the cognitive prerequisites are: (1) The child must understand what the outcome - success and failure - for a given task means and that the child has caused this effect himself. (2) The child must understand that this performance feedback means something for his or her own self-evaluation. This makes it necessary for the child to have at least a rudimentary concept of his or her own competence. Only when such understanding exists, should children react with achievement emotions proper to success and failure. Thus, cognitive evaluations and emotional reactions to achievement outcomes should be related to each other.

To document the beginning of a cognitive-emotional discrimination between skill-dependent outcomes and chance-dependent outcomes which cannot be evaluated according to some standard of excellence, we confronted children between the ages of 2 and 5 years with two different motor games in which comparable physical effects could be produced: (1) an achievement game in which children had to roll marbles through gates of different

widths at the end of a table (slide). Success and failure outcome was visible and, in addition, indicated by light and sound effects. The same physical game was used (2) as an effect game in which very similar light and sound effects could be produced through a simple movement of the child with no achievement appeal. The gate was removed for this game and each time the marble reached the end of the table an interesting sensory effect was produced: the lighting of a randomly chosen light and the release of a random sequence of 3 sinus tones.

We assume that the beginning of a cognitive-emotional discrimination between the two games will become manifest in signs of interest or attention (see Izard, 1979) and in quantitative and qualitative differences in positive and negative emotions exhibited. As soon as success and failure mean more than just interesting effects with no relevance for the self-evaluation of the child, children should discriminate in their emotional reactions between similar physical signals representing either a skill-independent effect or success and failure in an achievement task.

In addition to the assessment of emotional reactions via facial behavior we examined the understanding of the older children from 3 1/2 years on for the two tasks in a postexperimental interview. Contingent effects are experienced by infants differently from non-contingent effects when the time between effect and action is not longer than a couple of seconds (see Millar, 1972). Children demonstrate this through their instrumental and affective behavior (Papousek, 1967; Watson, 1966, 1967). However, contingency judgments reflect objective contingencies not before children enter the grade school years (Weiss, 1980, 1984).

Also a complete conceptual differentiation between chance-dependent events and skill-dependent events will not be reached before the age of adolescence. Nicholls & Miller (1983) reported that only approximately 50% of fourth grade children had achieved a major understanding of chance- and skill-dependent events. However, the verbally taped understanding might come later than an intuitive but working understanding of these differences.

Study I

Subjects of the first study were 40 preschool children, devided in four cohorts with 5 boys and 5 girls at each of the ages 3 1/2, 4, 4 1/2, and 5 years at the first time of observation. The first two cohorts were observed three times, the third cohort two times always with a 6 month intervale between observations. The 5-year-olds were observed only once.

Children were confronted in their preschools with the achievement and the effect game in alternating order on two consecutive days. Children played six games at each of the three difficulty levels (gaps) in the achievement game and rolled the marble just as often (18 times altogether) in the effect game. In addition, the experimenter also played six times in this situation. Video recordings were taken of the face and the upper trunk of the child and later analyzed with respect to the looking behaviors of the child and to his facial behavior using FACS (Ekman & Friesen, 1978). We analyzed the looking and facial behavior of the children in 6 randomly selected success-trials and 6 failure-trials in the achievement game, and in 6 randomly selected trials in the effect game and all experimenter trials in this game in a 5-second window beginning with the start of the marble.

Results

Our first question was if the different games and the situations therein - success and failure trials in the achievement game and

child and adult trials in the effect or chance game - attract a different amount of visual attention. The analysis of the looking behavior clearly demonstrates that the performance itself and the immediate results, the signal lights, attracts different visual attention in the two games and also for the different events produced in the two games. Children of all cohorts in the effect game look less often and for a shorter time to the rolling marble than in the achievement game (fig. 1). The diffence is significant for the first variable only in cohort D and E, for the second variable in cohorts F to G ($p < .05$).

Children looked in the achievement game also more often to the signal lights than in the effect game (fig. 1; $p < .01$). Within the two games they looked more often in the effect game to the signal lights when they rolled the marbles themselves than when the experimenter played and looked more often in the achievement game in success as compared to failure trials. This difference is only significant ($p < .05$) when the results are pooled for the age groups of the 4-year-olds, 4 1/2-year-olds and 5-year-olds. In addition, from 4 years on children look more often to the lamps signalling a success in the achievement game than in the effect game when they rolled the marble themselves (4-year-olds: $t(54) = 2.79$, $p < .01$; 4 1/2-year-olds: $t(81) = 2.47$, $p < .05$; 5-year-olds: $t(81) = 4.81$, $p < .01$, two-tailed).

From the mimic signs of attention listed by Izard (1979) only the wide open eyes (AU 5) discriminate in the first 3 cohorts between the two games: children exhibit this sign more often in the achievement game than in the effect game (fig. 2). Children also show this facial behavior more often in success than in failure trials and, as you will imagine, more often in the effect game when they roll the marble themselves than when the experi-

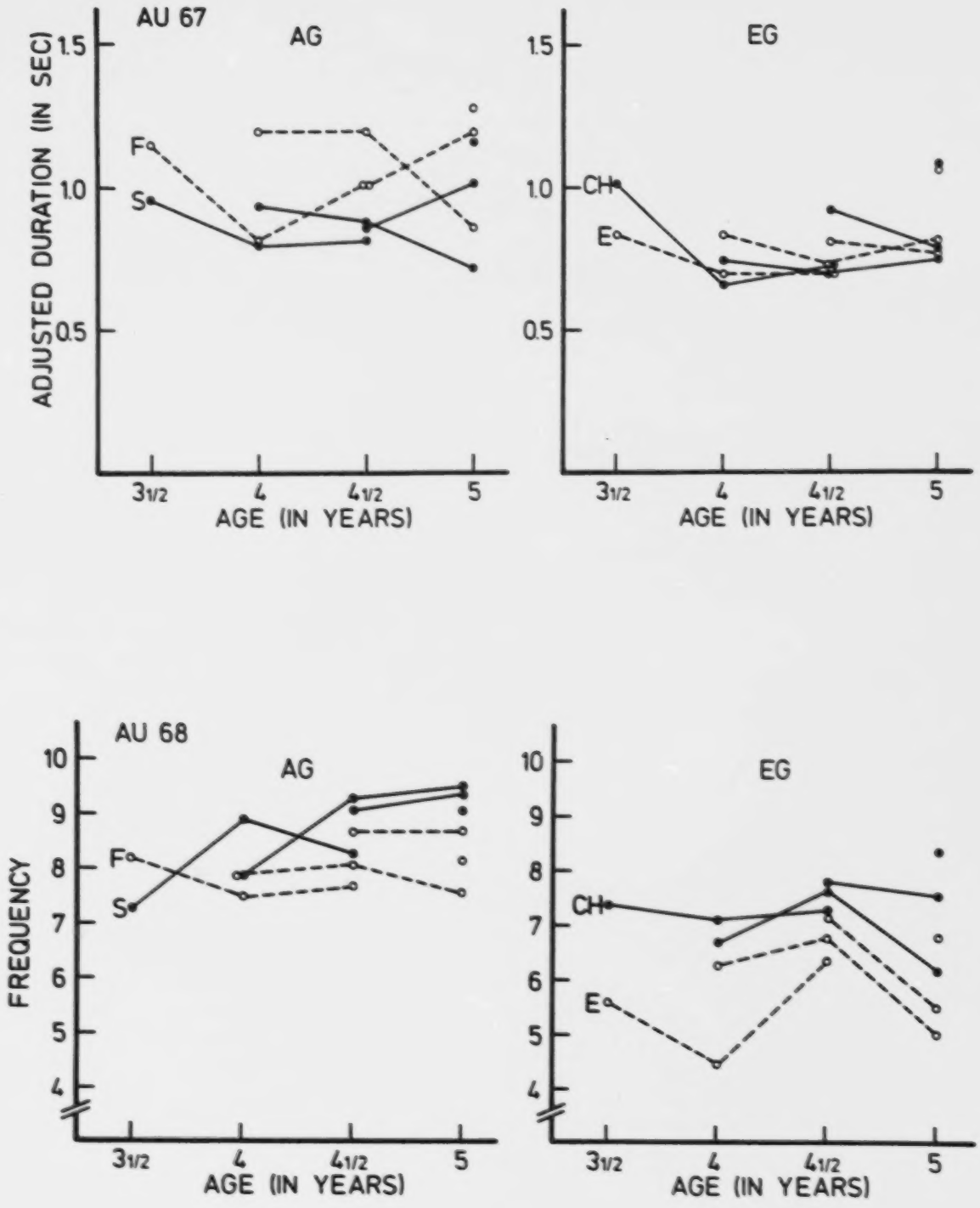


Fig. 1: Looking to the rolling marble (AU 67) and the signal lights (AU 68) during success (S) and failure trials (F) in the achievement game (AG) and during own (Ch) and experimenter trials (E) in the effect game (EG).

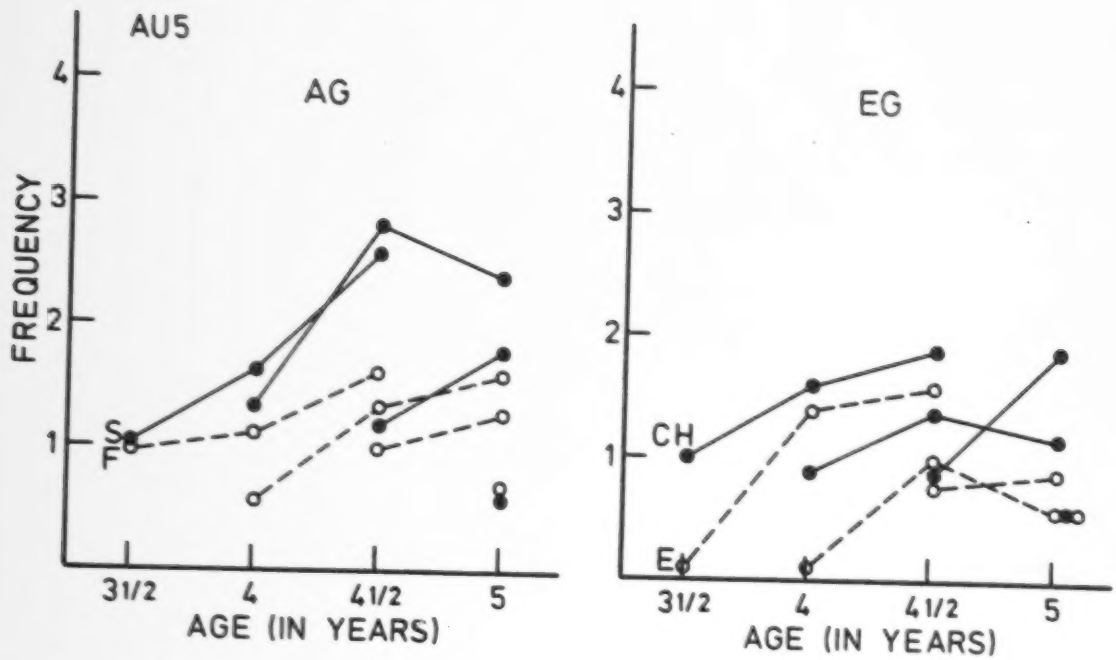


Fig. 2: Wide open eyes (AU 5) in success (S) and failure trials (F) in the achievement game (AG) and in own trials (Ch) and experimenter trials (E) in the effect game (E).

menter plays. However, only for the pooled cohorts are these differences significant ($p < .01$). In addition, only 4 1/2 year-olds demonstrate this reaction more often in success trials of the achievement game than in own trials of the effect game.

Summarizing, we conclude that preschool children differentiate behaviorally between events dependent on skill and events dependent on chance, although they seem not to be able to do so conceptually (see Weisz, 1984). Performance itself - i.e., the rolling marble - attracts more and longer visual attention in the achievement game than in the effect game. The signal lights also attract less attention in the effect game than in the achievement game where they represent success and failure feedback. In addition, children from 3 1/2 years on demonstrate one simple sign of attention more often in the achievement game than in the effect game. Therefore as well, the performance itself as the explicit success and failure feedback by these signal lights instigates more interest in preschoolers from 3 1/2 years on than random effects produced contingently by a comparable movement.

Children at this age demonstrate also differential interest in failure and success trials in the achievement game: They follow with their eyes the rolling marble in failure trials longer than in success trials - so as if they would make sure that they really didn't succeed, and look later to the signal lights in failure compared to success trials. However, they look more often to the signal lights in success than in failure trials: Apparently, positive feedback information is preferred compared to negative information.

Positive emotional reactions (joy and contentment). According to Darwin (1872) a true smile should consist of two movements, the reaction of the zygomaticus major (AU 12) and the reaction of the orbicularis oculi pars orbitalis (AU 6). Generally, however,

children show the zygomaticus reaction 2 to 3 times more often than the orbicularis reaction. We expected more joy and therefore more manifestation of both movements especially in combination with success trials than in failure trials of the achievement game and also more joy and contentment in success trials as compared to children's trials in the chance game as soon as children understand the difference between skill-dependent and chance effects. The next figure (fig. 3) demonstrates differences between the two games and the situations therein for the four cohorts. There are no apparent differences between the games and the situations except for the more trivial differences between experimenter and child trials in the effect game. However, the time courses of the manifestation of these two movements over the periods of measurements is quite different for two of the three cohorts. From time of observation to time of observation both movements are shown decreasingly less in the two younger cohorts in the effect game but increases are shown first in the achievement game. It seems that if children habituate rather fastly to the chance effects, they do not react with as strong positive emotions during the second and third encounter with this game but react more and more emotionally in the achievement game.

This increasingly stronger manifestation of the signs of positive emotions in the achievement game also becomes manifest in the analysis of an overlap score of the two constituents of a true smile, the orbicularis and the zygomaticus reaction. Figure 4 presents corrected temporal overlap scores for these two movements. As can be seen from the figure (fig. 4) the common appearance of these two movements increases from 4 years on in the achievement game but stays at the same low level in the chance game. The difference between the two games for 4 1/2 and

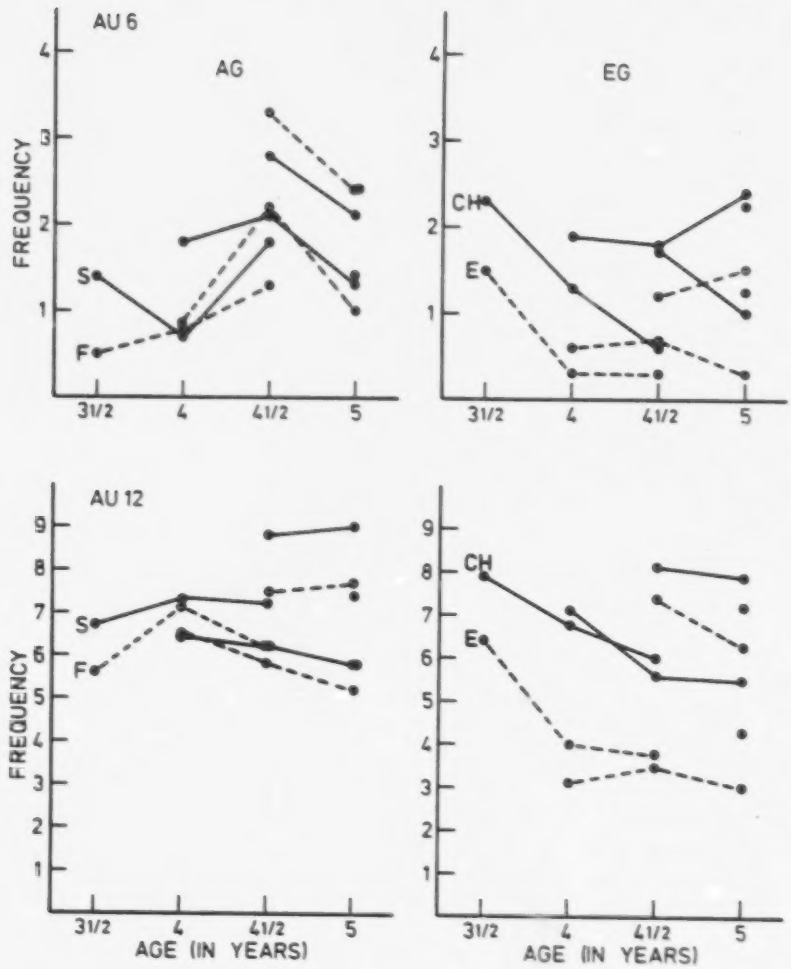


Fig. 3: Orbicularis oculi (AU 6) and zygomaticus major reaction (AU 12) during success (S) and failure trials (F) in the achievement game (AG) and during own (Ch) and experimenter trials (E) the effect game (EG).

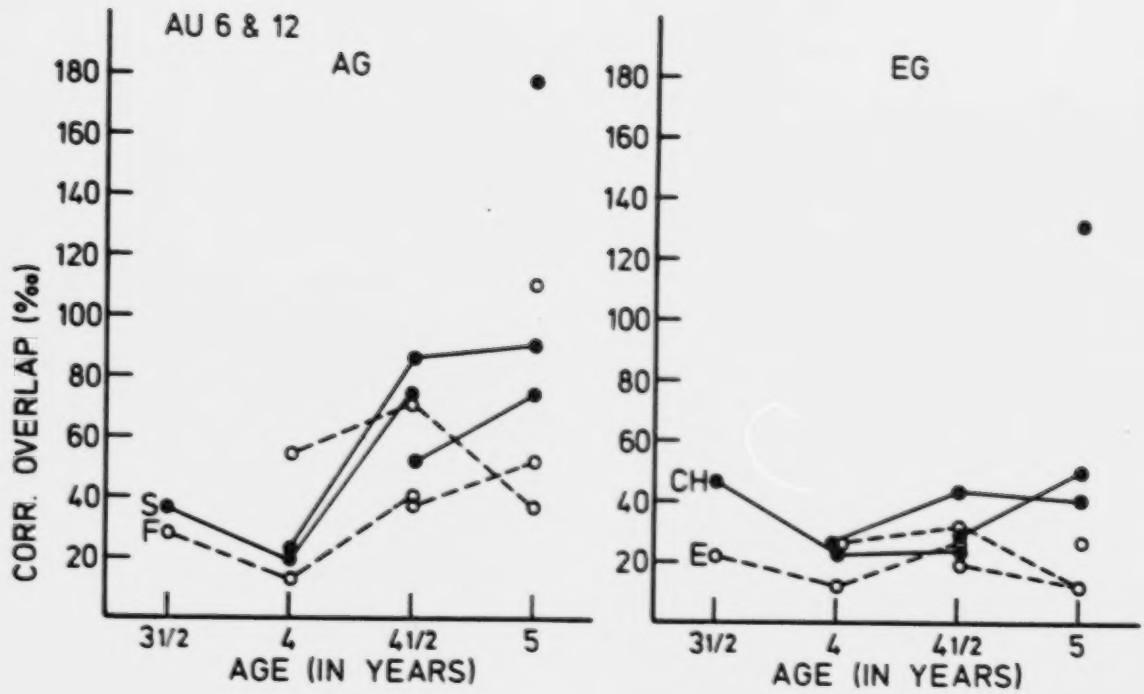


Fig. 4: Corrected overlap score for the common appearance of AU 6 and AU 12 during success (S) and failure trials (F) in the achievement game (AG) and during own (Ch) and experimenter trials (E) in the effect game (E).

5-year-olds are significant (ps < .01). The difference between success and failure trials are not significant. However, the differences between success trials in the achievement game and child trials in the effect game are significant for the 4 1/2 and 5-year-olds (ps < .05).

The fact that children manifest as much of a true smile according to Darwin in failure than in success trials was unexpected. The only significant differences we observed between success and failure trials in the morphology of smiling was with respect to a weighted score for action unit 12 (zygomaticus reactions) in which the frequency was weighted by the scaled intensity of these reactions. In all cohorts children had a higher intensity-frequency score of the zygomaticus reactions in success than in failure trials (fig. 5). However, also this difference is significant only in the 4th cohort as well as in the whole sample ($p < .01$). We also looked if the zygomaticus reaction and the full smile (AU 6 and AU 12) is also more often combined with an open mouth in success as compared to failure trials. In only one of the cohorts(C 3) was such a difference observed. Smiling in success trials, therefore, is somewhat more intensive than in failure trials but still it remains true that children also smile in failure trials.

We may assume that the children's smile in a failure trial is a communicative act, a commentary on this happening. This assumption is supported by an analysis of the latency of AU 6 and AU 12 (fig. 6). By determining the latencies only for those children who had shown both movements at least in one success or failure trial, the latencies of both movements were longer in failure than in success trials ($p < .05$, one-tailed for both movements).

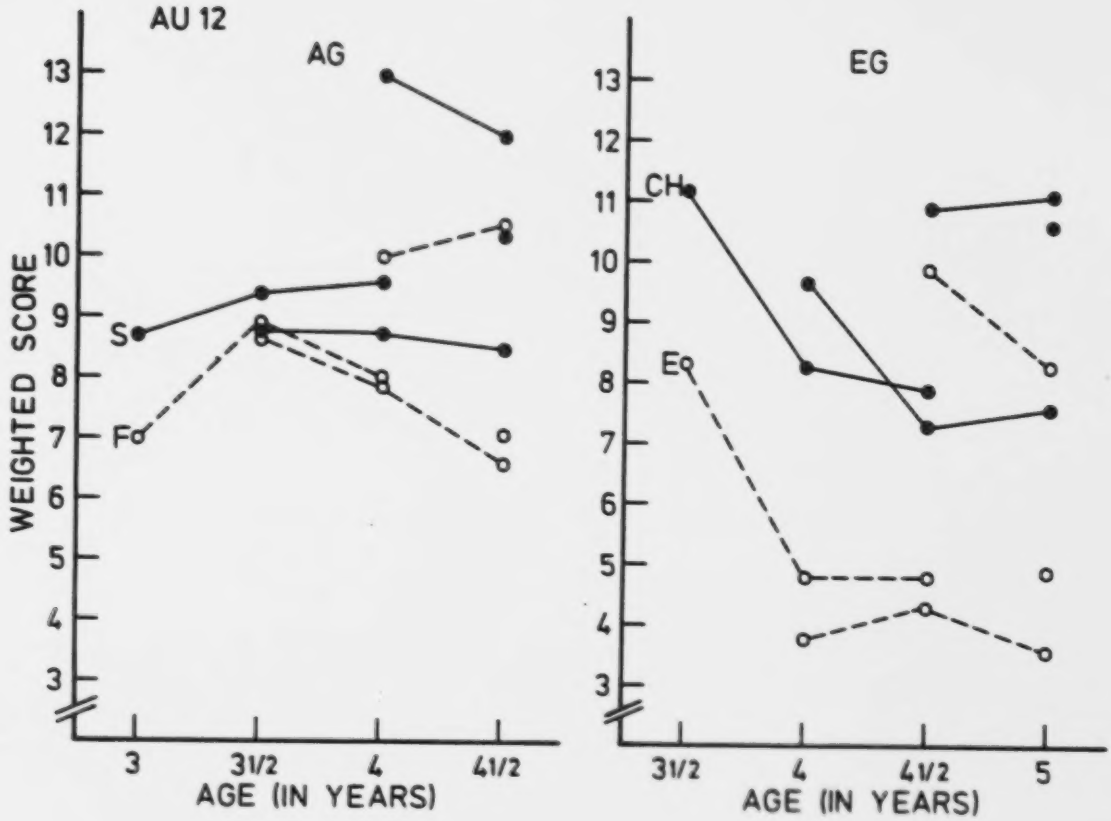


Fig. 5: Weighted frequency (frequency x intensity) of the zygomaticus major reaction during success (S) and failure trials (F) in the achievement game (AG) and during own (Ch) and experimenter trials (E) in the effect game (EG).

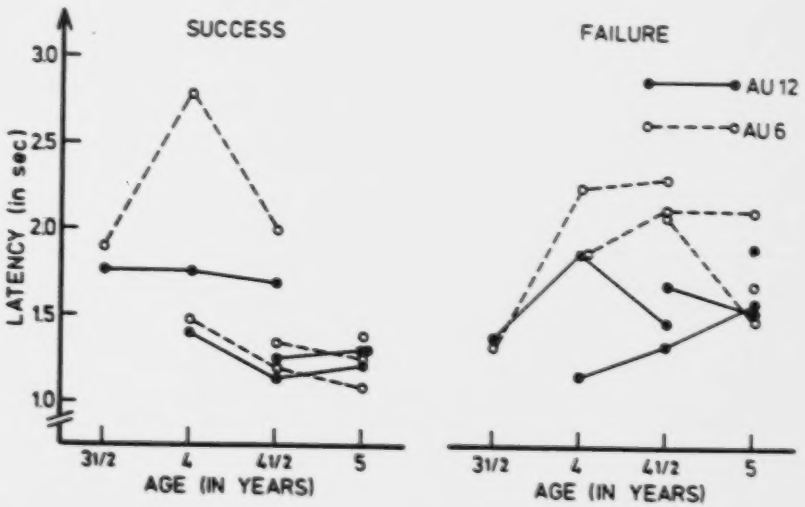


Fig. 6: Latencies of the orbicularis oculi (AU 6) and the zygomaticus major reactions (AU 12) after success and failure feedback.

If smiles in failure trials are communicative acts, they should also be more often associated with the look to the experimenter sitting at the child's left side. However, we did not find such associations. Summarizing, we must conclude that, with more experience with the task and growing cognitive understanding of the two games, positive emotions become more prominent in the achievement game as compared to the chance game, however, not before the age of 4 1/2 years. Only then do children exhibit a "true smile" (AU 6 and AU 12) longer in success trials in the achievement game than in own trials in the effect game. Smiling is observed on the other side as often in failure as in success trials although less intensive in failure trials. A true smile, the coincidence of the orbicularis and the zygomaticus reaction is not shown by our children longer during the success trials than during failure trials. However, they need longer in failure trials to exhibit smiles as compared to the success trials: A failure has to be appraised and in a case where it is commented in this way, demonstrating to the experimenter that it is not that bad at all, the smile requires more time than a spontaneous emotional reaction.

Study II

We observed children between 2 and 3 years old while they played the same two games and who came with their parents to the institute. These children showed generally a fair amount of facial behavior, yet manifested no differences between the two games and success and failure trials in the achievement game. The only differences we found were between child and experimenter trials in the effect game and also in the achievement game: their looking behavior as different indices of attention and joy and contentment discriminated between these situations as well. This

supports the well-grounded assumption that children discriminate emotionally between self and other produced effects.

Conclusions

Going back to the questions we started with, the results support the following conclusions:

- Children between 2 and 3 years do not differentiate emotionally and, with respect to their visual attention between the two games, the achievement game and the effect game. They do differentiate, however, between own trials and experimenter trials in both games.
- Children from 3 1/2 years on differentiate with respect to their manifested interest between the two games. Achievement-performance and achievement-performance feedback attracts more attention and instigates more mimic signs of interest.
- Not before the age of 4 1/2 do we find morphological differences between a smile expressing joy about a success in an achievement game and a smile expressing joy about a contingently triggered but otherwise chance-determined effect. In success trials the two constituents of a smile according to Darwin show more overlap in time than in own trials of the effect game. In addition, children habituate to the effects in the effect game - even to the self-produced - with repeated observations and manifest less and less joy, i.e., smile less and less, but not so in the achievement game.
- In our sample we could not differentiate morphologically between success and failure smile. The only morphological difference we found was with respect to the scaled intensity of the zygomaticus reaction. In success trials children

showed a more pronounced zygomaticus reaction than in failure trials.

Summarizing, we must conclude that functional mechanisms, the behaviors of information search, and the amount of attention or interest attached to these behaviors discriminate at an earlier age between these two games than expressed emotion, especially joy. The specific ages when children demonstrated these differential reaction to both games might be specific for these games, however, the sequence of the appearance of these functional systems should be not. Generally, all these behavioral indices are present at an age when preschoolers still have a long way to go in achieving a conceptual differentiation between skill-dependent and chance-dependent action outcomes. We believe that this behavioral discrimination enables children in preschool years to deal effectively with such different games - achievement games remain attractive obviously longer than chance games - long before they understand what this difference is all about.

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